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Crystallographic examination of the interaction between texture evolution, mechanically induced martensitic transformation and twinning in nanostructured bainite

Lucia Morales-Rivas^{1*}, Fady Archie², Stefan Zaefferer², Miguel Benito-Alfonso³, Shao-Pu Tsai⁴, Jer-Ren Yang⁴, Dierk Raabe², Carlos Garcia-Mateo³, Francisca G. Caballero³

¹ Technische Universität Kaiserslautern (TUK), Materials Testing, Gottlieb-Daimler-Str., 67663, Kaiserslautern, Germany

² Max-Planck-Institut für Eisenforschung GmbH, Max-Planck Str. 1, D-40237 Düsseldorf, Germany

³ Department of Physical Metallurgy, National Centre for Metallurgical Research (CENIM-CSIC), Avda. Gregorio del Amo 8, E-28040 Madrid, Spain

⁴ Department of Materials Science and Engineering, National Taiwan University, 1, Roosevelt Rd. Sec. 4, Taipei, Taiwan

*e-mail address: rivas@mv.uni-kl.de

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ABSTRACT

The deformation mechanisms operating in nanostructured bainite, leading to its excellent combination of strength and ductility, are far from being understood. Its nanocrystalline nature and its multiphase-evolving structure underlie the plastic flow and the strain-hardening behaviour.

In this work, the microstructural and crystallographic bulk changes of a high-C nanostructured bainite under tensile testing have been evaluated. The influence of the mechanically-induced transformation of the C-enriched retained austenite into α martensite and other deformation mechanisms on the texture evolution has been analysed by electron backscatter diffraction (EBSD). Additionally, the undeformed and the deformed conditions have been examined by electron channelling contrast imaging (ECCI) and transmission electron microscopy (TEM). Results reveal the presence of plate martensite and suggest a strong variant selection during the transformation, mainly responsible for the texture observed. Mechanical twinning in austenite seems to be basically the mechanism of accommodation of the displacive bainitic transformation, while some direct interaction with the applied stress also appears.

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